

## **ATTACHMENT D**

### **Forest Fringe Samples Results**

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Samples were collected from the "forest fringe" (forested areas adjacent to sampled child-use areas) at four selected child-use areas. Three of the selected areas were in Zone 1 (near Burton, Dockton, and Point Robinson); the fourth was in Zone 2 (at the elementary school). The objective in sampling at these forest fringe areas was to provide area-specific data allowing comparisons to be made for contaminant levels on relatively undisturbed versus developed properties (see Section 2.0).

The sampling protocols for forest fringe samples were identical to those used for the child-use area samples. All forest fringe samples were collected using GeoProbe<sup>TM</sup> methods and included the same 5 depth intervals between 0 and 22 inches used for child-use area samples. Four borings were sampled at each forest fringe area, with sample codes assigned using the same sample coding system and a new DU designation. Thus, a total of 20 sample results are available for each forest fringe area samples.

All forest fringe samples were analyzed for arsenic and lead, using the same protocols as for child-use area samples. The results from OnSite Environmental, Inc. were included in the data validation reviews conducted by EcoChem, Inc. All results were found suitable for use in further data evaluations.

The arsenic and lead results for forest fringe samples are provided in Table D-1. The depth profiles, lead versus arsenic correlations, and variability in the forest fringe results are all comparable to those in the initial soil survey of forest soils on Vashon-Maury Island. Additional information is available for depth profiles in the forest fringe results. The depth profiles for three of the four forest fringe areas show a rapid decrease in arsenic concentrations below 6 inches. At those three areas, the maximum arsenic values below 6 inches are 7.9 percent, 10.7 percent, and 20.3 percent of maximum values within the top 6 inches. The fourth area (the elementary school) has a comparable value of 37.7 percent. One boring has a depth pattern different from the other three at this location. Lead results with respect to depth profiles are similar, except that lead in general shows even less downward mobility than arsenic (as expected). The pattern at the elementary school is even more anomalous for lead than for arsenic; the ratio of maximum values below versus above 6 inches is 58.1 percent. The anomalies at this location could reflect natural variability or a comparatively higher degree of actual soil disturbance in the forest fringe (a possibility supported by field observations).

The forest fringe results were compared to the results for samples from their matched child-use areas. A summary of the Maximum and Average (larger of 0-2 inch and 2-6 inch) concentrations for forest fringe versus child-use areas is provided in Table D-2. The depth intervals are shown for each reported Maximum or Average concentration in Table D-2. The ratio of forest fringe to child-use area results is also shown for each comparison.

Inspection of Table D-2 reveals several interesting patterns. The forest fringe results generally exceed those from their matched child-use areas (i.e., most ratios are greater than 1). Only one arsenic Maximum value and one lead Maximum value from forest fringe areas are less than the comparable values at child-use areas (and the differences are not large in either case). Thus, whether evaluated based on Maximum or Average concentrations, the developed child-use areas show less near-surface soil contamination by arsenic and lead than nearby forest fringe areas. The ratios for Average concentrations are larger than the matched ratios for Maximum concentrations in all 8 cases. Therefore, there is a greater difference between forest fringe and child-use areas for average concentrations. This is consistent with a conceptual model in which property development actions dilute, mix, or remove soil contamination to a degree that varies from one location to another at a property, so that Maximum results more closely approach forest fringe contamination levels. At three of the four sampled areas, the Maximum child-use area results for arsenic and lead were both within a factor of 1.79 or less of the Maximum forest fringe results (and actually exceeded the forest fringe values in two cases, as noted). The fourth area shows much higher ratios for all forest fringe versus child-use area results, which may reflect a greater effect of property development actions on original soil contaminant levels.

A third finding is that Average concentrations (within the top 6 inches) are always at 0-2 inches in the forest fringe areas, but are at the 2-6 inch depth interval about half the time in child-use areas. This suggests that original contaminant soil profiles in forest soils are being affected by property development actions, resulting in more complex depth profiles at the child-use areas.

Although only four forest fringe areas were sampled for this preliminary study of contamination patterns at developed versus nearby undisturbed areas, the results provide considerable insight into the comparative patterns of arsenic and lead in near-surface soils. The relationship at other child-use areas, or other developed properties on Vashon-Maury Island, may differ from these results. Property-specific development histories are likely to affect the patterns at individual locations. These preliminary findings should not be automatically assumed to apply to other unsampled locations.

[illegible]

Vashon-Maury Island											
Child-Use Areas Study											
Public Health - Seattle & King County											
2001											
				Table D-2							
			Comparison of Child-Use Area and Forest Fringe Results								
			(in ppm, DW)								
			Maximum Concentrations				Average Concentrations				
	Location	Type	Arsenic	depth	Lead	depth	Arsenic	depth	Lead	depth	
	1-38-1	CUA	41	2	51	2	11.99	2	20.19	2	
	1-38-3	FF	140	1	390	1	111.50	1	285.00	1	
	ratio	FF/CUA	3.41		7.65		9.30		14.12		
	1-39-1	CUA	86	1	360	1	29.75	1	78.10	2	
	1-39-6	FF	150	2	240	1	91.75	1	167.50	1	
	ratio	FF/CUA	1.74		0.67		3.08		2.14		
	1-42-2	CUA	36	3	72	2	15.08	1	24.89	2	
	1-42-3	FF	59	1	120	1	48.50	1	100.75	1	
	ratio	FF/CUA	1.64		1.67		3.22		4.05		
	2-6-1	CUA	43	1	100	4	23.89	1	48.48	1	
	2-6-2	CUA	64	2	95	5	16.95	2	31.63	1	
	2-6-3	CUA	59	1	150	1	15.24	1	49.93	1	
	targeted	CUA	70	1	240	1					
	2-6-4	FF	61	1	430	1	42.25	1	181.50	1	
	ratio	FF/CUA	0.87		1.79		1.77		3.64		
	NOTE										
	CUA = child-use area										
	FF = forest fringe										
	At child-use area 6, ratios are based on the largest CUA result.										